SONY

VIALTA

Sony Multi Resolution Telecine

FVS-1000 System

Vialta™ – TELECINE FROM SONY

Telecine combines both technology and art. In reinventing telecine, Sony's central priority was to deploy multiple new technologies specifically designed to further the art of telecine while empowering the colorist to easily meet the escalating demands of digital imaging from analog motion picture film. For the past twenty years Sony has been immersed in refining the technologies that bridge the two worlds of high definition electronic imaging and motion picture film imaging. That accumulated experience has been combined with other cutting-edge technologies to offer the creative world a new level of performance capability in a Telecine. We call this the Vialta system.

The Evolution is Here

The Vialta system focuses exclusively on the imperatives of an all-digital age: highest possible picture quality, broader color correction flexibilities, simultaneous digital HDTV, SDTV, and real-time data output interfaces. The total system was rigorously re-examined in six core domains:

The optical *Image Preparation* system

- **Sprocket wheel drive**
- **Optical system**
- **Light source**

The digital *Image Optimization* system

- **CCD image sampling**
- **DSP processing**
- **Multi resolution input/output interfaces**

The front-end *Image Preparation* system, which is comprised of the film transport, light source, and optical system constitute a closely linked entity that predetermine the positional stability, and the transmitted RGB light levels presented to the three high resolution CCD imagers. Vialta's intermittent film transport is augmented by a powerful Optical Picture Stabilizer system to ensure a rock-steady image transfer. The Vialta system recognizes the wide ranges of film densities among the extensive population of positive and negative motion picture films likely to be encountered. A highly refined digitally controlled light-valve system that operates frame by frame in real time constitutes a powerful first level of Color Grading prior to the image sensors – thus ensuring very low noise and superb tonal and color reproduction in the digital transfers. This, in combination with the excellent image stability, ensures optimum operation of the many downstream compression engines encountered today (from DVD mastering, to various digital transmission systems, to digital cinema).

The Vialta system's digital *Image Optimization* unit starts with the innovation of area array CCD imagers – the first Telecine ever to employ this technology. Each of the three RGB imagers are 1920 x 1080 Frame-Interline Transfer CCDs. This critically important

image capture constitutes full resolution sampling of the RGB images, which translates into razor-sharp digital transfers from S35 mm and 35 mm film – and unparalleled picture sharpness from S16 mm and 16 mm films. Optical options are available that ensure S35/35 mm, S16/16 mm, Leica Slide, Vistavision and anamorphic film formats are accurately mapped to the full imager sampling lattice. The utilization of area array CCD imagers significantly extends the exposure time for each film frame, which further enhances the signal-to-noise performance of the Telecine transfer, and ensures the comprehensive translation of all information contained within the film image.

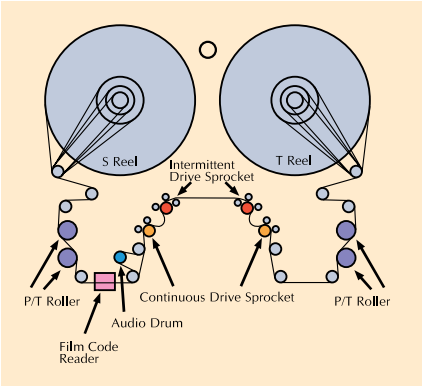
The image processing continues with logarithmic amplifiers down stream of the CCD imagers. This is followed by three, high-speed, 12-bit Log, A/D converters. The digital signals are then processed at up to 16 bits utilizing Sony's proprietary state-of-the-art DSP processing technology. Digital HD-SDI and associated controls which interface to all of the leading third-party color correction system are also incorporated.

Anticipating the need for greater efficiencies in the telecine process, the Vialta system is designed for simultaneous multiple outputs. Always capturing progressive images at full bandwidth 1920 x 1080 resolution (22:22:22), Sony's cutting-edge processing technology enables Data, HD and SD serial digital outputs to occur simultaneously at progressive scan rates selectable between five and 30 frames per second. RGB data (linear or Log), digital HD, and 601 formats, can all be output at the same time. SD 601 outputs are selectable for 525-line and/or 625-line derivatives. Finally, the Vialta system's RGB data output, in both Log and Linear formats is transferred in real time to a disk recorder or computer workstation for the ultimate in high resolution imaging efficiency.

The optical *Image Preparat*

Sprocket Wheel Drive – Uncompromising Image Stability

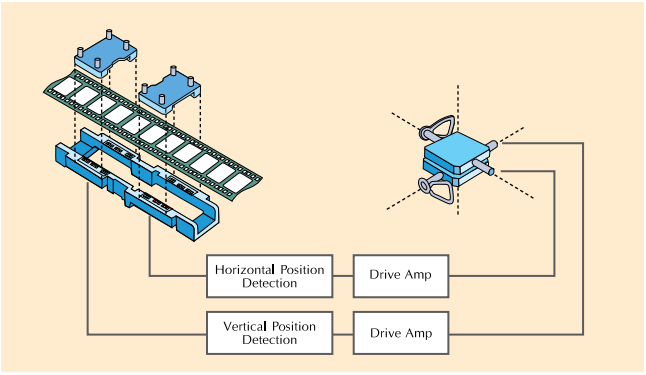
To date, capstan drive has proven the most common method of transporting film in telecines. Capstans effectively move the film in real time through the telecine gate while relying on edge guides and gate paths to minimize unwanted film movement, or weave, in the gate. Over the years we have seen this approach improve, but mechanical edge guides and fixed gate paths cannot account for all of the variables in film stocks which ultimately result in varying degrees of weave and movement as the film is pulled across the gate aperture and exposed.



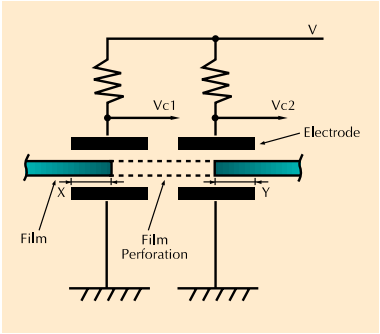
The Vialta system's highly precise transport system was developed to maximize image stability, while ensuring transport mechanisms never touch the picture area of the film, and guarantee film safety in all modes of operation. Utilizing both continuous and intermittent motion sprockets, the Vialta system's transport effectively provides a broad range of operating speeds with precision response and the ultimate in film handling care. Tension and loop sensors throughout the transport path virtually ensure that any film anomaly capable of causing damage to the film in transport is detected. If detected, the transport will come to an immediate halt, minimizing the possibility of any damage to the film. The VTR-like transport control helps the colorist to quickly locate a desired picture frame in a range of up to 150 Fps. Furthermore, the Vialta system accommodates various types of film formats by supporting 2, 3, 4, and 8 perforation modes, which can be selected from the Vialta system's control panel or from remote machine control.

Optical Picture Stabilizer – Robust Correctional Device

Needless to say, image stability is extremely critical in the digital age where virtually every digital recording will ultimately be subjected to some form of data compression.



OPS is an opto-electronic image stabilizer system which provides pin registered image quality without the use of mechanical pins. This is accomplished through the use of film perf position detectors located on the film gate that sense the film frame position in both the horizontal and vertical planes. These detectors measure the difference in capacitance between air (the perforation) and the film. Positioning data is derived by using a pair of capacitors that are not affected by variations in film base material, film density, or by environmental condition. This positioning information is processed by a microprocessor, which interprets the data across a range of readings while compensating for local errors such as damaged or irregularly pitched perforations. The microprocessor controls optically flat glass plates (x + y axis), which are located between the film plane and the CCD imager. If the film is correctly positioned, the glass plate remains parallel to the film plane. If the film frame is slightly offset, the glass plate tilts by a carefully calibrated amount to refract, and therefore shift, the light path. Unlike a pin-registration mechanism that adjusts the physical position of the film, the illuminated image is guided to the imager, by refraction, to an accuracy of +/- one HD pixel in both horizontal and vertical planes.

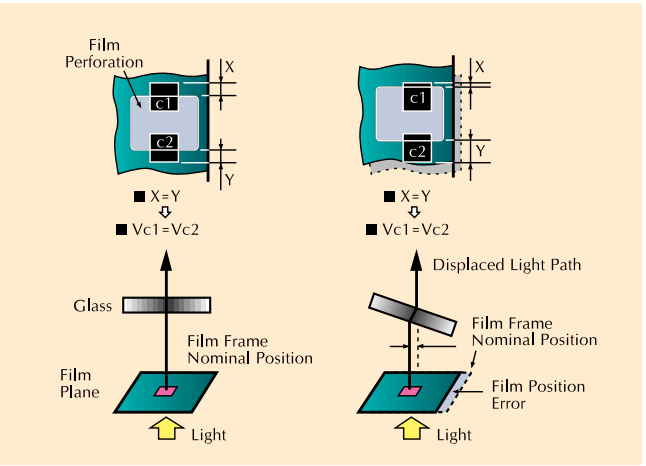


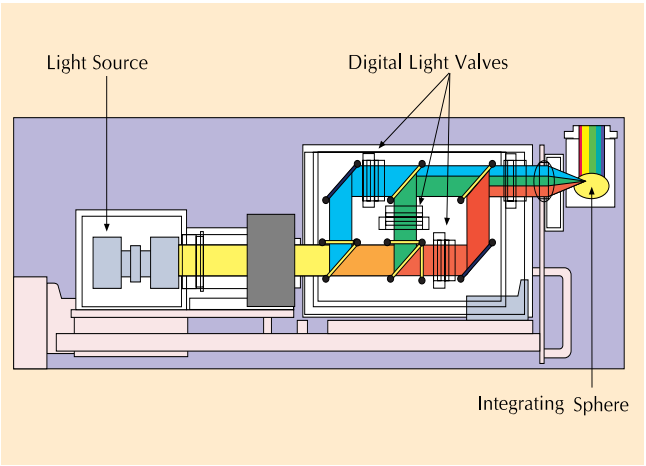
Light Source – A Central Element of Optimum Colorimetry

Primary color correction in the optical domain can tremendously decrease noise as compared to the electronic signal methods. In order to achieve this, the Vialta system employs a lamp house assembly as shown in the figure below.

The light source is an easily replaceable, 300 W Xenon lamp. As the light enters a series of dichroic filters, it is split into RGB light elements. Extremely precise dichroic filters allow only the purest RGB (red, green, and blue) light components to pass, thereby optimizing the light for the color dyes of the film.

Each of the three RGB light paths is equipped with a highly responsive and precise digitally controlled light valve that varies each of the RGB light components governing both the color composition and intensity of light to the film. These strictly filtered RGB light components are then combined in the Integrating Sphere where the light is diffused, minimizing the effects of minor film dirt and scratches and rendering any shading problems caused by the light source negligible. The end result is a faithful reproduction of the film's color properties without the introduction of electronic noise or the bias of an electronic color matrix.

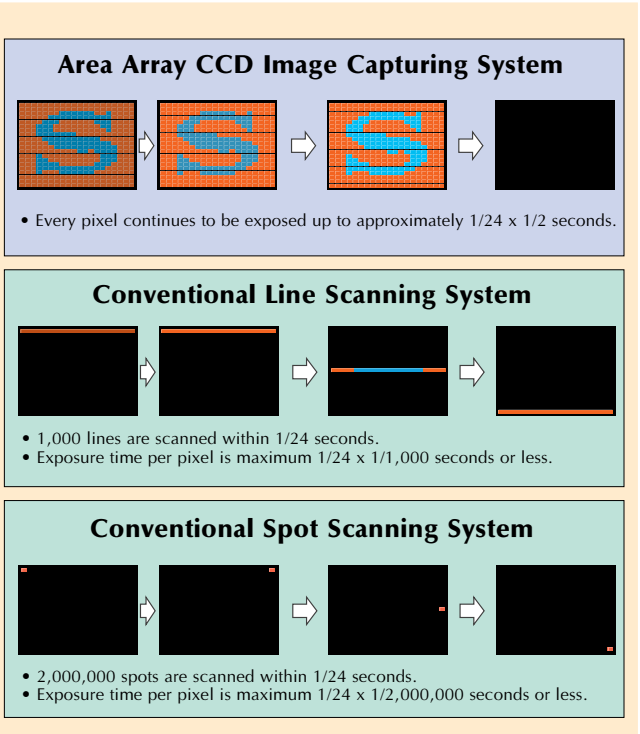




The digital *Image Optimiza*

CCD Image Sampling – Area Array CCD for Telecine Systems: A Perfect Match

The Vialta system applies the same principle as a professional motion picture film camera, in which frame-based image capturing is used to ensure the highest possible image quality. As the film frame is kept stationary during the exposure, the Vialta system captures the entire frame by innovative Area Array CCD imagers. Each of these RGB imagers is the same 1920 x 1080 Frame-Interline Transfer CCD, utilized across the range of Sony's high resolution camera/camcorder acquisition equipment. The greatest advantage of adopting the area array CCD method is that razor-sharp digital transfers are possible with minimal noise. The area array CCD can achieve surprisingly long exposure times of up to 500 times the exposure time of a line scanning system, or 1,000,000 times that of a spot scanning system. The latitude of long exposure time combined with the digitally controlled light source produces virtually noise free imaging.

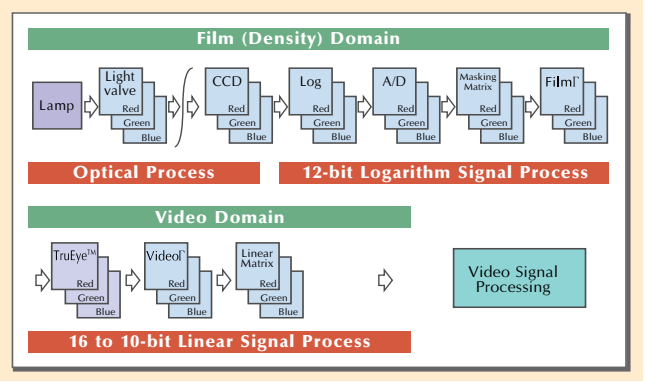


Utilizing Area Array CCD imagers and the intermittent sprocket wheel drive combination also provides a live picture in both run and stop mode. At no time is the user viewing the output of a frame store. This means optical adjustments such as iris, focus, lamp control, filter selection, and framing adjustments can be executed and viewed while the film is stationary in the film gate.

DSP Signal Processing – Optimized conversion process

RGB Independent Logarithmic Signal Processing

After framing and primary color correction are processed in the optical domain, the adjustment for film gamma is digitally processed. In order to handle the diverse characteristics of the different film emulsions, the film gamma correction takes place in the logarithmic, or film density, domain. Here the high quality analog signals captured by the area array CCDs travel through logarithmic amplifiers where RGB signals are independently processed, and converted to 12-bit log at a sampling frequency of 74 MHz. In addition, the Vialta telecine provides a total of 16 selectable film gamma tables for each of the RGB signals, which can be modified as required (16 each for negative, inter-positive, and print film stocks).

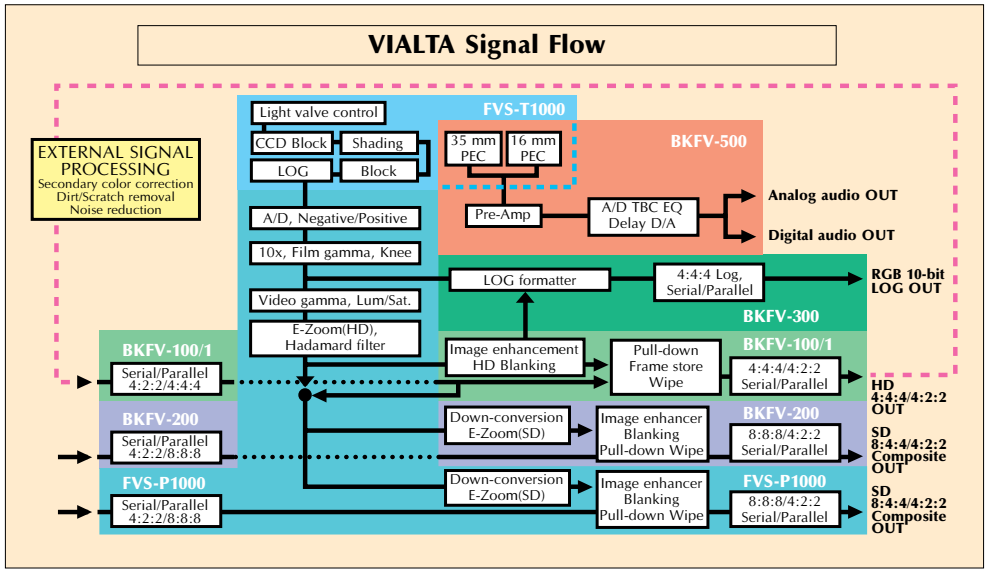


RGB Independent Linear Signal Processing

After the film gamma is adjusted, the logarithmic data are converted into linear data to allow image manipulation in the video domain. The 12-bit log data are first converted to 16-bit linear, and then converted to 12 bits. Video gamma correction is performed at 12-bit resolution by modifying the gamma curve with 11 adjustable points per picture frame. In order to match the bit depth resolution of monitors, the signal is reformatted to 10 bits after video gamma correction, passed through the linear matrix, and sent to the video processing stage.

Multi-resolution Input/Output Interfaces – Unsurpassed Expandability

The Vialta system can handle a maximum of three independent video signal processing channels at a time, two SDTV and one HDTV channel, and one high resolution RGB data channel. Since format conversion, picture framing, image enhancement, skin detail, and pull down functions are provided with each video processing channel, multiple signal formats can be obtained with one run of the film. Thus, the Vialta telecine not only offers simultaneous output of 525 or 625 SDTV and HDTV resolution, but allows simultaneous output of different aspect ratios (16:9 and 4:3 pan scan) for the two SDTV signal processing channels, while outputting 1080/24P HDTV, and RGB real-time data. For SDTV formats, picture resolution can be selected as 4:2:2 via single SDI or, 4:4:4 via double SDI connection. For HDTV format, picture resolution can be selected as 4:2:2 or 4:4:4 via HD-SDI or dual-link HD-SDI respectively. The Vialta system's unique signal path is also worthy of mention. Its signal path structure is such that color correction is performed over one HD-SDI signal fed to the secondary color corrector which is then routed back to the Vialta system's built-in down converter. This approach ensures that all video outputs in both HD and SD carry the same secondary color correction and signal processing benefits. Furthermore, to enable color comparisons between different scenes, there is an internal wipe generator for simple split screen monitoring. This is used in combination with the SDTV video processing channel, and an internal frame store that handles a maximum of 16 stills in SDTV and 4 HDTV stills. Additional stills can be recalled from an external device through the video input port.



Other Features

Enhanced User Friendly Primary Calibration Functions

By simply selecting the film type (negative, inter-positive, or print), the Vialta system automatically calibrates the center of the primary color correction range (the track ball position) to the machine's TAF presets defined for optimum transfers. This significantly reduces set up time and allows the colorist to begin immediately without having to create and/or call up base memory configurations for specific film types. This function is particularly useful when transferring dailies.

Shading Calibration Function

This function enables the Vialta system to instantly recall the shading correction topography of the optical system by lens type (35 mm or 16 mm).

Optional Accessories

BKFV-100/1,
Telecine HDTV Processing Board
(Supports Dual Link HD-SDI)

BKFV-200,
Telecine SDTV Processing Board

BKFV-300,
Telecine Log Data Processor

BKFV-400/1,
16 mm Film Adaptor Kit
(Supports 16 mm Zoom Lens)

BKFV-410,
Telecine Optical Conversion Kit

BKFV-420,
Telecine Mounted Slide Kit

BKFV-500,
Telecine Film Sound Processor

FVS-1000 System Specifications

General		
Dimensions (W x H x D)		1173 x 1798 x 780 mm (46 3/8 x 71 1/4 x 30 3/4 inches)
Mass		Approx. 650 kg (1433 lb)
Power requirements	U.S and Canada	AC 120 V, 50/60 Hz
	Other areas	AC 220 to 240 V, 50/60 Hz
Power consumption	U.S and Canada	30 A, 15 A for outlet
	Other areas	17 A, 8 A for outlet
Film transport		
Film format		35 mm and Super 35 mm (4 and 3 perforation)
	Optional	35 mm Cinema Scope
	Optional	35 mm 8 perforation and slide
	Optional	16 mm, Super 16 mm
Film type		Negatives, Prints, Inter-positives
Film gate		35 mm film gate
	Optional	16 mm film gate
Film capacity		Max. 2500 ft.
Film core type		2 inch, 3 inch and 5 inch for 35 mm
		2 inch, 3 inch and 5 inch for 16 mm
Film drive		Sprocket driven by AC servo motors*1 Supply and take-up reel driven by AC servo motors
Film drive lock-up time		4 film frames from stand-by ON (Still) to Play
Film frame rate		23.976, 24, 24.975, 25, 29.97, 30 Fps forward and reverse mode
Variplay mode		±(5.00 - 30.00 Fps), in steps of 0.01 Fps with an optional BKFV-100/1
Step mode		Single step forward and reverse mode
Stop mode		True Still frame mode
Shuttle mode		Max. 5 times normal playback speed at 35 mm film
		Max. 5 times normal playback speed at 16 mm film
Variable mode		±2 times normal playback speed
Film image acquisition system		
Image acquisition device		3-chip 2/3-inch type 2-million pixels FIT type area CCD (1920 x 1080 pixels for each CCD imager)
Light source		Xenon lamp 300 W
Diffuser		Integrating sphere
Lens		35 mm zoom master lens and standard conversion lens
	Optional	35 mm anamorphic conversion lens (1.33/1.5)
	Optional	35 mm 8 perforation conversion lens
	Optional	16 mm zoom lens
Lens control		Remote motorized servo control for Iris, Focus, and Zoom
ND filter		Clear, 1/4 ND, 1/16 ND, 1/64 ND
CC filter		Cross, 3200 K, 4300 K, 6300 K
CCD block movement	Horizontal	24 mm at 35 mm film plane
	Horizontal	12 mm at 16 mm film plane
	Vertical	28 mm at 35 mm film plane
	Vertical	14 mm at 16 mm film plane
	Rotation	210°
	Electronic 180° rotation, H flip, V flip	Only when HD Zoom is off
Primary color correction system		
Optical gain control		R, G, and B independent intensity control
Electronic gain control		R, G, and B and Master
Pedestal level control		R, G, and B and Master
White/black shading		Parabola and Saw tooth independent horizontal, vertical and R, G, B
Gamma control		Negative, print and inter positive with coarse and fine control
Saturation control		-∞ to +3 dB
Luminance control		-∞ to +3 dB
Sampling rate and quantization		12-bit logarithmic R/G/B independent at 74 MHz (for each CCD imager)
Post Lift/Gain		R, G, B and Master

*1 The two inner sprockets provide intermittent motion during playback, and provides continuous motion during shuttle.
The two outer sprockets permanently provide continuous motion.

*2 Measured at 50% video level, gamma = 0.4.
The ratio being 700 mV divided by r.m.s noise voltage at the below condition:
Film Type: IP
Imager gain: M:2, R, G, and B; A000
Iris: 0000
Film Gamma: 7
Detail gain: 0000
Back level: Setting all 7 FFF and after adjust 350 mV by Master level

*3 It shows the status and film counter. As the pulldown sequence is not considered, the film counter value in stop mode is correct, but that in running mode may have an error of one frame.

HDTV functions (with an optional BKFV-100/1 installed)	
System	1080/60I, 30Psf, 30P 1080/59.94I, 29.97Psf, 29.97P 1080/50I, 25Psf, 25P 1080/48I, 24Psf, 24P 1080/47.952I, 23.976Psf, 23.976P
Electronic zoom	Area magnification: 0.25x to 4x by zoom or independent X and Y sizing with pan and tilt affecting SD (625/525) picture
Blanking control	Independent X and Y adjusting
Image enhancer	Horizontal and vertical aperture correction with crispening, level depend, horizontal and vertical peak frequency, detail gain control, H/V mix ratio, source RGB, skin tone detail
Frame store	For reference frame, 4 frames
Wipe	Horizontal and vertical wipe, Source selection: main, input, frame store
Signal to noise ratio	For luminance better than 58 dB*2
Video input	HD SDI (4:2:2) or dual HD SDI (4:4:4)
Signal path	External Device Delay 0 to 15 frame
Video output	HD SDI (4:2:2) or dual HD SDI (4:4:4) Monitor out (HD SDI (4:2:2) with a superimposed signal)*3
Sequence output	Pulldown sequence pulse
Test SG output	H Ramp, V Ramp, Multi-Burst 100% CB, 75% CB, Black, White
SDTV functions	The FVS-1000 system is furnished with one channel of SDI processing board. A second channel can be configured by adding the BKFV-200 SDTV processing board.
System	525/625 switchable
Electronic zoom	Area magnification: 0.25x to 4x by Zoom or independent X and Y sizing with pan and tilt including Crop, Squeeze, and Letter box
Blanking control	Independent X and Y adjusting
Image enhancer	Horizontal and vertical aperture correction with crispening, level depend, horizontal and vertical Master and detail gain control, H/V mix ratio, source RGB, skin tone detail
Frame store	For reference frame, 16 frames
Wipe	Horizontal and vertical wipe, Source selection: main, input, frame store
Signal to noise ratio	For luminance, better than 62 dB*2
Video input	D-1 SDI (4:2:2, Max. 3 channels) and dual D-1 SDI (4:2:2:4 or 4:4:4:4 or 8:4:4:4)
Video output	D-1 SDI, dual D-1 SDI (4:4:4, 8:4:4), or D-1 SDI with a superimposed signal*3. Monitor out (analog composite with a superimposed signal)*3
Sequence output	Pulldown sequence pulse
Test SG output	H Ramp, V Ramp, H Sweep, V Sweep, 100 % CB, 75 % CB, Black, White, R, G, B
Reference Input/Output (Analog)	
HD input/output	Tri-level sync field rate: 60/59.94 50 48/47.952
SD input/output	Black burst (NTSC/PAL) 525 sync 625 sync
Remote interface	
RS-422	Telecine controller I/F D-sub 9-pin
Other device interface	
Tacho pulse	bi-phase tacho x 10 AUX 3, 4, D-sub 9-pin
	bi-phase tacho x 1 AUX 5, 6, D-sub 9-pin
LOG functions (with an optional BKFV-300 installed)	
System	1080/30Psf, 30P 1080/29.97Psf, 29.97P 1080/25Psf, 25P 1080/24Psf, 24P 1080/23.976Psf, 23.976P (The output frame rate is automatically set with the film rate.)
Signal source	Film gamma output (MY board) or HD enhancer output (EN board)
Signal format	SMPTE: conforming to the SMPTE "Logarithmic Distribution of Digitized 4:4:4:4 Video Signals" format
	CINEON: conforming to the KODAK "The Cineon Digital Film System Version 2.1" format
Signal length	10 bit each color/pixel
Signal color space	4:4:4 RGB or 4:4:4 Y/C (The 4:4:4 signal flows in dual HD-SDI output.)
Audio functions (with an optional BKFV-500 installed)	
Reproduction method	Laser lam (690 nm)
	Optical pickup: monaural/stereo reproduction (35 mm film), monaural reproduction (16 mm film)
Output	ANALOG OUT (D-sub 15-pin): Analog audio output (D-sub 15-pin/XLR 3-pin conversion using the supplied cable)
	DIGITAL OUT (D-sub 15-pin): Digital audio output (conforming to the AES/EBU format, D-sub 9-pin/XLR 3-pin conversion using the supplied cable)
Output level	+4 dBu ±1 dB at film reference tone, Adjustable range: ±6 dB
Delay compensation	0 to 15 frames (controlling output A and B independently)
Test signal generator	1 kHz (analog out: +4 dBu, digital out: -20 dBFS)
Equalizer	CUT: LPF (8 kHz to 16 kHz, adjustable) Boost: Slitloss EQ (40 steps, adjustable)
Frequency response	40 Hz to 12.5 kHz ±2 dB with 35 mm film
Signal-to-noise ratio	More than 70 dB
Reference output level	+4 dBu

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Distributed by

BC-00878
MK7783V1SMC01DEC

Printed in Japan